SAFETY ASPECT IN INSTALLATION OF INDUSTRIALIZED BUILDING SYSTEM (IBS) FORMWORK IN MALAYSIAN CONSTRUCTION INDUSTRY

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of the Bachelor Degree of Civil Engineering.

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at University Malaysia Pahang or any other institutions.

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ABSTRAK

Teknologi Sistem Bangunan Perindustrian (IBS) yang baru muncul telah mencapai momentum sebagai campurtangan untuk meningkatkan keselamatan di kalangan pekerja. Aspek keselamatan yang sangat penting harus diterapkan pada mana-mana projek pembinaan bagi mencegah kemalangan yang akan mengakibatkan kecederaan dan juga kematian. Pemasangan komponen kotak acuan IBS tidak terkecuali daripada bahaya. Matlamat projek ini adalah untuk mengkaji proses kerja pemasangan kotak acuan IBS, untuk mengenalpasti aspek keselamatan dan tahap keselamatan, dan untuk mengenal pasti faktor-faktor untuk meningkatkan keselamatan pemasangan komponen IBS. Terdapat empat proses kerja pemasangan kotak acuan IBS termasuklah mengangkat, meletakkan, menstabilkan dan proses menanggalkan, dan aspek-aspek keselamatan yang berkaitan yang perlu dilaksanakan semasa proses telah dikenalpasti dalam kajian literatur. Penemuan ini mendedahkan enam faktor yang dikaitkan dengan peningkatan keselamatan tapak pembinaan IBS di Malaysia. Faktor-faktor tersebut ialah faktor bersifat sejarah, faktor psikologi, faktor teknikal, faktor prosedur, faktor organisasi dan faktor persekitaran. Struktur soal selidik telah direka dan diedarkan kepada responden dengan matlamat untuk menilai pemahaman dan kesedaran mengenai keselamatan dalam pemasangan IBS. Pandangan pengamal dalam pembinaan IBS termasuk kontraktor dan perunding telah diambil dan dikumpulkan melalui pendekatan kuantitatif. Borang soal selidik yang dipulangkan telah dianalisis dengan menggunakan indeks purata dan kaedah analisis frekuensi. Keputusan menunjukkan bahawa aspek keselamatan yang dipersetujui responden yang perlu dipatuhi adalah pekerja perlu dilengkapi Peralatan Perlindungan Peribadi. Hasilnya juga menunjukkan bahawa keselamatan berada pada tahap yang baik pada semua fasa proses pemasangan. Tambahan pula, dari analisis, faktor psikologi disenaraikan sebagai faktor yang paling penting yang menyumbang kepada meningkatkan keselamatan dalam pemasangan IBS. Faktor psikologi adalah termasuklah mengenai kesedaran diri dan pengaruh dari tingkah laku rakan sekerja. Kesimpulannya, aspek keselamatan amat penting. Bagi meningkatkan keselamatan dalam kerja IBS sehingga mencapai kemalangan sifar, pekerja terlatih dan mahir diperlukan untuk pembinaan IBS, oleh itu latihan yang betul adalah harus ditekankan.

ABSTRACT

Emerging technology of Industrial Building System (IBS) has gained momentum as an intervention to improve the safety among workers. Safety aspect is very important must apply to any construction project to prevent accidence that resulting injury and fatalities. Installation of component IBS formwork is not excluding from having hazard. The goals of this paper are to study the process installation of IBS formwork, to identify the safety aspect and level of safety, and to identify the factors for improving safety in installation of IBS formwork. A total four process installation of IBS formwork which is lifting, placing, bracing and stripping process, and the relevant safety aspect that has to be applied during the process were identified in literature review. The findings disclosed six factors linked to the safety improvement of IBS construction site in Malaysia. The factors were historical, psychological, technical, procedural, organisational and the environmental factors. Structures of questionnaire was designed and distributed to the respondents with aim to assess their understanding and awareness regarding to the safety in installation IBS formwork. The viewpoint of practitioners in IBS construction including contractors and consultants was captured and collected through the quantitative approach. Returned questionnaire were analyses with used average index, frequency analysis method and mean. Result has shown respondent strongly agreed safety aspect need to apply is workers equipped with Personal Protective Equipment (PPE). The results also indicate that the safety is in good level at all phases. Furthermore, from the analysis, a psychological factor ranked as most crucial factor contributing to safer in installation IBS formwork. The psychological factor included the self-awareness and influences from workmates behaviour and least is environmental factor. To conclude, safety aspect is needed to apply. In order to improve safety of IBS formwork until zero accidents, a well trained and skilled workers are required for IBS construction, thus proper training is permissible and should be emphasised.

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INTRODUCTION

1.1 Introduction

In general safety is related to any precaution to avoid any hazards that might be occurred in all circumstances. In construction industry, both in traditional method or in Industrialized Building System (IBS) strives to maintain and practicing safety aspect for every workers. The construction industry in Malaysia has been introduced with the IBS. Now, the construction industry that was once only use traditional methods have been moved to a more innovative method which is Industrialized Building System, where projects are mostly based more on the product based. IBS is a construction system that built using prefabricated components. A formwork is classified as one of the IBS components. Besides, the construction method of IBS is where the components are manufactured off-site or factory and once completed it will be delivered to construction sites for assembly and erection (S. S. Kamaruddin, 2013). The work process of IBS formworks has its own significance and deficiency to be compared with traditional method.

In construction industry, innovation of building system is considered necessary in order to cater to the increasing demand of industry products. Lately the government through the body CIDB (Construction Industry Development Board) seriously promote the use of Industrialised Building System (IBS) in the construction sector. IBS is believed to provide a construction system that promises better quality, fast and cost effective (Nawi, 2011; Nawi, 2014a). In order to improve the effectiveness and implementation of IBS in construction industry, the safety requirement during the process of work at site being considered. The safety in installation of IBS formwork component in building is included in this consideration.

Safety aspect in construction is a major importance and it has to apply to any construction project.

The IBS formwork that includes metal or steel, aluminium and plastic gained its popularity recently due to its flexibility of application in many projects, recyclables at many phase of construction and can be used in different types of design structure (Baharuddin, 2015). From that point, it giving a significance impact towards the importance of IBS formwork system applied in the Malaysian construction industry. The lack of knowledge in IBS formwork system among the Malaysian construction industry has giving consequences in creating problem in safety aspect and safety requirement.

IBS in Malaysia has begun in early 1960's when Ministry of Housing and Local Government of Malaysia visited several European countries and evaluate their housing development program (Thanoon *et. al.*, 2003). After their successful visit in 1964, the government had started first project on IBS aims to speed up the delivery time and built affordable and quality houses. About 22.7 acres of land along Jalan Pekeliling, Kuala Lumpur was dedicated to the project comprising seven blocks of 17 stories flat there are 3000 units of low-cost flat and 40 shops lot. Based on research in Malaysia Project Online, the IBS component (Steel formwork system) that has been used in buildings in Malaysia is Public Housing Project at Telipok, Sabah.

1.2 Background of Study

Industrialised building systems (IBS) is defined as the overall structural components of a building, including walls, floors, roofs, stairs, etc. that were built at the factory or at the project site with the supervision of the quality factor and reduced activity at the construction site (Trikha, 1999). IBS is a construction process that utilises techniques, products, components, or building systems which involve prefabricated components and on-site installation. From the structural classification, there are five IBS main groups identified as being used in this country, and these are:

i. Pre-cast Concrete Framing, Panel and Box Systems – pre-cast columns, beams, slabs, 3-D components (balconies, staircases, toilets, etc)
ii. Formwork Systems – tunnel forms, EPS-based forms, beams and columns moulding forms, permanent steel formworks
iii. Steel Framing Systems – steel beams and columns, portal frames, roof trusses
iv. Prefabricated Timber Framing Systems – timber frames, roof trusses, etc;
v. Block Work Systems – interlocking concrete masonry units (CMU), lightweight concrete blocks, etc.

Formwork in construction is the use of support structures and moulds to create structures out of concrete which is poured into the moulds. The IBS formwork system includes steel, aluminium and timber formwork system. CIDB Malaysia, in collaboration with various organizations representing the construction industry, has been urged to use innovative construction techniques, and to shift from the traditional practice of brick and mortar systems to an Industrialised Building System (IBS) of construction (Hamid, 2011). One of the technique is called as IBS formwork system which able to speed up the delivery time, and to build affordable and quality houses.

IBS formwork construction give lessens the problem of site wastages and the related environmental problem. There is three important phases to be looked out in categorised of IBS which are manufacturing, delivering and also the construction phase. Then, the most important element during the sequence of construction is the planning. During the manufacturing phase, the IBS components are usually done at the factory. All this phases includes considering the aspect of safety requirement that need to be applied by all workers (N. Nasir, 2012). The construction phase of formwork especially for high rise building is the most challenging stage as it involves with several activities.

IBS has been identified as a potential solution to improve the overall performance of a project including the safety aspect. It is a system which uses industrial production techniques either in the production of components or assembly

REFERENCES

(2008). Retrieved from Industry Resources Formwork.

(2010, June 10). Retrieved from http://civilresourcess.blogspot.my/2010/06/formwork.html

Brooks, R. G. (2008). The use of Formwork in Construction.

S. S. Kamaruddin, M. F. Mohammad, R. Mahbub, and K. Ahmad. Industrialised Building System Readiness Formwork (2013). Procedia-Soc. Behaviour. Sci. 105, 106.

M. Zaki, W. M. (2016). Safety in IBS Construction. *12* (3), 2367-2373.

A. Rahim, A. H. (2008). *Causes of Accidents At Construction Sites*. Malaysian Journal of Civil Engineering , *20* (202), 242-259.

K. Anuar, M. K. (2011). *Industrialized Building System (IBS)*: Revisiting Issues of Definition and Classification. *1* (June), 120-132.

Bashir, A. A. (2009). *Simulation safety management of IBS construction.* Declaration of Thesis Undergraduate Project Paper and Copyright .

Yuen, C. Y. (Apr 21, 2017). *Case Studies of Accidents Involving working at Heights.* National Work at Heights Safety Taskforce Workplace Safety and Health Council.

D. Abang Abdullah, G. W. (2010). *An Analysis of Accidents Statistics in Malaysian Construction Sector*. International Conference on E-business, Management and Economics , 3, 1-4.

H. Chong, T. L. (2014). *Accidents in Malaysian construction industry: Statistical data and court cases.* International Journal of Occupational Safety and Ergonomics , 20 (3), 503-513.

Sawacha, E., Naoum, S., and Fong, D. (1999). *Factors Affecting Safety Performance on Construction Sites*. International Journal of Project Management, Vol. 17, No. 5, pp 309-315.

Langford, D., Rowlinson, S., and Sawacha, E. (2000). *Safety Behaviour and Safety Management: Its Influence On The Attitudes of Workers In The UK Construction Industry*. Blackwell Science Ltd, Engineering, Construction and Architectural Management, pp 133-140.

Heaney, R. (2016). Formwork Code of Practice. 402-408.

Code of Practice for Working Safely at Heights. (2009). Revised 2013, WSH Council, Singapore, 69 p.

Maamor, N. Y. (2009). *Safety aspect in installation industrialized building system (IBS) component.* (November).

N. Nasir, Z. I. (2012). *Enabling Factors Towards Safety Improvement for Industrialised Building System (IBS).* International Journal of Architectural and Environmental Engineering , 6 (12), 1115-1120.

Workplace Health and Safety. Queensland. (2006). Formwork. Code of Practice 2006.

Mohd Faiz Mohammad Zaki, W. Z. (2016). *Safety in IBS Construction:* -. Arau, Perlis, Malaysia : lobal Journal of Pure and Applied Mathematics.ISSN 0973-1768 Volume 12, Number 3 (2016), pp. 2367–2373.

Nunez, I. and Villanueva, M. (2011). *Safety Capital: The Management Of Organizational Knowledge On Occupational Health And Safety*, Journal of Workplace Learning, Vol. 23 Iss: 1, pp.56 – 71.

M. Nawi, M. M. (2014). *Suitability of IBS Formwork System in Malaysian Construction Industry.* Australian Journal of Basic and Applied Sciences , 8 (April), 231-238.

Adilah Arma Shaari, M. F., W. Muhammad et al. (2016). *Safety of Precast Concrete Installation for Industrialised Building System Construction.* International Journal of Applied Engineering Research ISSN 0973-4562 Volume 11, Number 13 (2016) pp 7929-7932.

Workplace Health and Safety. (2006). Formwork. Code of Practice 2006.

A. Charehzi, A. A. (2012). *Enhancement of safety performance at construction site.* International Journal of Advances in Engineering & Technology , 5 (1), 303-312.

K. Anuar, M. K. (2011). *Industrialized Building System (IBS*): Revisiting Issues of Definition and Classification. *1* (June), 120-132.

D. Yakubu, I. B. (2013). *Evaluation of Safety and Health Performance on Construction Sites*. (Kuala Lumpur). (2), 100-109.

Nicolas S.Y. Yeung, A. P. (2015). An Overview of the Construction Industry Private sector.

William R. Mincks, H. Johnston. (2011). *Construction Jobsite Management*. (3rd Edition)